We claim:

1. A measurement system comprising:

a source unit configured to provide a source signal to a sample, the source unit comprising:

at least one of a voltage source and a current source; and

a memory configured to store a source calibration;

a measurement unit configured to acquire from the sample a measurement signal responsive to the source signal, the measurement unit comprising:

at least one of a voltage measuring unit, a current measuring unit, and a capacitance measuring unit; and

a memory configured to store a measurement calibration; and

a control unit comprising:

a digital signal processing unit;

a source converter connected between the digital signal processing unit and the source unit;

a measurement converter connected between the digital signal processing unit and the measurement unit;

a synchronization unit configured to synchronize clocks of the digital signal processing unit, the source converter, and the measurement converter;

a calibration unit for calibrating the system including the control unit; and

a reference voltage supply configured to supply a common reference voltage for the control unit, wherein the control unit is configured to:

calibrate a measurement channel against the common reference voltage;

command the source unit to apply a positive signal in place of the source signal;

measure, via the calibrated measurement channel, the commanded positive signal to yield a measured positive signal;

command the source unit to apply a negative signal in place of the source signal;

measure, via the calibrated measurement channel, the applied negative signal to yield a measured negative signal; and

command the source unit to apply a zero signal in place of the source signal;

measure, via the calibrated measurement channel, the applied zero signal to yield a measured zero signal; and

generate a source unit calibration based on a difference between a first signal and a second signal, wherein:

the first signal comprises at least one of the commanded positive signal, the commanded negative signal, and the commanded zero signal; and

the second signal comprises at least one of the measured positive signal, the measured negative signal, and the measured zero signal.

2. The system of claim 1, wherein the control unit is configured to obtain at least one of:

calibration data from a self-calibration performed by the source and measurement units;

calibration data from a stored factory calibration;

calibration data from a remote source via the Internet;

calibration data from a user input;

the source calibration data from the source unit; and

the measurement calibration data from the measurement unit.

3. The system of any one of claims 1 and 2, wherein the control unit is configured to obtain at least one of:

the source and measurement calibrations periodically;

the source calibration from the memory of the source unit when the source unit is not providing the source signal to the sample;

the measurement calibration from the memory of the measurement unit when the measurement unit is not acquiring a measurement signal from the sample; and

the source and measurement calibrations concurrently.

4. The system of any one of claims 1-3, wherein at least one of:

the digital signal processing unit stores calibration data for at least one of the control unit, source unit, and measurement unit;

the measurement and source units are remotely located from the control unit and the digital signal processing unit;

the system comprises a first cable connecting the control unit to the measurement unit and a second cable connecting the control unit to the source unit;

digital signals in at least one of the measurement unit and the source unit are isolated from the control unit;

a measurement interface between the measurement unit and control unit and a source interface between the source unit and the control unit are isolated from one another within a cable;

the system comprises a plurality of source units;

the system comprises a plurality of measurement units;

the source unit is configured to acquire the measurement signal; and

the measurement unit is configured to provide the source signal.

5. The system of any one of claims 1-4, wherein the current source unit is configured to measure a source current associated with the source signal via a sensing resistor and vary a resistance range of the sensing resistor according to a magnitude of the source current.

6. The system of claim 5 further comprising at least one of:

a current source protection unit configured to determine whether the source current exceeds a threshold current and when the source current exceeds the threshold current, alter a feedback element of at least one of the source unit and the measurement unit so that the source current falls below the threshold current; and

a voltage source protection unit configured to determine whether a source voltage exceeds a threshold voltage and when the source voltage exceeds the threshold voltage, alter a

feedback element of at least one of the source unit and the measurement unit so that the source voltage falls below the threshold voltage.

7. The system of any one of claims 1-6, wherein the synchronization unit is configured to synchronize the digital signal processing unit, the source converter, and the measurement converter with respect to an internal clock signal.

8. The system of any one of claims 1-7, wherein the digital signal processing unit is configured to provide timestamps for at least one of the measurement signal and the source signal.

9. The system of any one of claims 1-8, wherein at least one of:

the source unit is configured to deactivate non-analog circuitry when providing the source signal; and

the measurement unit is configured to deactivate non-analog circuitry when measuring the measurement signal.

10. The system of any one of claims 1-9, wherein the digital signal processing unit is configured to perform at least one of the following with respect to at least one of the measurement and the source signal:

a lock-in analysis;

an Alternating Current/Direct Current (AC/DC) measurement;

an inductance (L), capacitance (C), and resistance (R) (LCR) measurement;

a time/scope domain presentation;

a frequency domain analysis;

a noise analysis;

an AC/DC sourcing;

a control looping; and

providing the source signal from more than one source.

11. The system of any one of claims 1-10, wherein at least one of an interface between the source unit and the control unit comprises low impedance buffered analog signals and an interface between the measurement unit and the control unit comprises at least one of:

a voltage mode analog signal interface with low impedance transmitting and high impedance receiving circuitry; and

a current mode analog signal interface with high output impedance transmitting and low impedance receiving circuitry.

12. The system of any one of claims 1-11, wherein at least one of:

a power supply is configured to supply power to the control unit, the source unit, and the measurement unit referenced to a common ground;

the system comprises a power supply filter to at least one of the measurement unit and the source unit; and

at least one of the measurement unit and the source unit is powered from at least one of an isolated power converter from the control unit, an isolated external power source, and battery power.

13. The system of any one of claims 1-12, wherein at least one of the source converter and the measurement converter comprises:

a gain chain configured to amplify an analog input signal;

a range selector configured to select a gain between the analog input signal and multiple analog-to-digital converter (ADC) outputs, wherein each ADC output has a path, and a gain of each output path is made up of gain stages in the gain chain; and

a mixer configured to combine the multiple ADC outputs into a single mixed output.

14. The system of any one of claims 1-13, wherein the source converter comprises:

two or more digital-to-analog converters (DAC) combined to generate one or more frequency components;

a first path for generating low frequency signals, the first path comprising a first one of the DACs;

a second path for generating high frequency signals, the second path comprising a second one of the DACs;

a data processor for processing an input signal;

a combining circuit configured to combine outputs of the first and second paths into the source signal;

a feedback portion configured to sense the source signal; and

a servo loop configured to employ the feedback portion to maintain the source signal in accordance with the input signal.

15. The system of any one of claims 1-14, wherein the digital signal processing unit is configured to perform lock-in signal processing and wherein the lock-in signal processing at least one of:

is synchronized with the synchronization unit;

processes at least one of a fundamental frequency and a harmonic frequency; and

comprises providing a lock-in reference for communication between the control unit and at least one of the source unit and the measurement unit.

16. The system of any one of claims 1-15, wherein the control unit is configured to measure a parameter of the source signal using a feedback signal that is one of a DC signal and a low frequency AC signal.

17. The system of any one of claims 1-16, wherein the control unit is configured to assess a type of at least one of the measurement unit and the source unit, wherein the type refers to at least one of the voltage source or the current source of the source unit and the at least one of the voltage measuring unit, current measuring unit and capacitance measuring unit of the measurement unit, and configure the digital signal processing unit according to the type.

18. The system of any one of claims 1-17, further comprising at least one of:

an enclosure for at least one of the source unit and the measurement unit, the enclosure comprising at least one of electrostatic shielding and magnetic shielding; and

a configurable display that is configured to at least one of:

display real time oscilloscope readings; and

display frequency spectrum readings.

19. The system of any one of claims 1-18, wherein the control unit is configured to at least one of:

perform a voltage measure mode calibration for the measurement unit by:

measuring an offset error at the measurement unit;

storing the offset error in the memory of the measurement unit;

connecting an amplifier associated with the measurement unit to a reference voltage;

measuring, via the control unit, a gain error from applying the reference voltage to the amplifier;

storing the measured gain error in the memory of the measurement unit;

reading, via the control unit, at least one of the stored gain error from the memory of the measurement unit; and

applying at least one of the offset error and the gain error to correct a voltage measurement; and

perform a current mode measure calibration for the measurement unit by:

disconnecting input connectors of the control unit;

connecting input connectors of the measurement unit to ground;

configuring the measurement unit in a voltage measure mode;

measuring voltage offset errors of an amplifier via the measurement unit in voltage measure mode;

applying an analog correction to decrease the measured voltage offset errors to approximately zero;

switching the measurement unit to a current measure mode and floating inputs to the measurement unit;

determining, via the control unit, voltage offset errors between the measurement unit and the control unit by configuring the measurement unit in a high current range and measuring a resultant voltage at the control unit;

adjusting a leakage current until a current measurement of the measurement unit is approximately zero;

storing, via the control unit, at least one of the adjusted leakage current and the voltage offset errors in the memory of the measurement unit;

reading, via the control unit, at least one of the adjusted leakage current and the voltage offset errors; and

applying at least one of the adjusted leakage current and the voltage offset error to correct a current measurement of the measurement unit.

20. A method comprising:

providing a source signal to a sample via a source unit comprising:

at least one of a voltage source and a current source;

a memory configured to store a source calibration;

acquiring from the sample a measurement signal responsive to the source signal via a measurement unit, the measurement unit comprising:

at least one of a voltage measuring unit, a current measuring unit, and a capacitance measuring unit;

a memory configured to store a measurement calibration; and

receiving the measurement signal from the measurement unit by a control unit, the control unit comprising:

a digital signal processing unit;

a source converter connected between the digital signal processing unit and the source unit;

a measurement converter connected between the digital signal processing unit and the measurement unit;

a synchronization unit configured to synchronize clocks of the digital signal processing unit, the source converter, and the measurement converter;

a calibration unit for calibrating aspects of the system including the control unit; and

a reference voltage supply configured to supply a common reference voltage for the control unit;

calibrating, via the control unit, a measurement channel against the common reference voltage;

commanding, via the control unit, the source unit to apply a positive signal in place of the source signal;

measuring, via the calibrated measurement channel, the commanded positive signal to yield a measured positive signal;

commanding, via the control unit, the source unit to apply a negative signal in place of the source signal;

measuring, via the calibrated measurement channel, the applied negative signal to yield a measured negative signal;

commanding, via the control unit, the source unit to apply a zero signal in place of the source signal;

measuring, via the calibrated measurement channel, the applied zero signal to yield a measured zero signal; and

generating, via the control unit, a source unit calibration based on a difference between a first signal and a second signal, wherein:

the first signal comprises at least one of the commanded positive signal, the commanded negative signal, and the commanded zero signal; and

the second signal comprises at least one of the measured positive signal, the measured negative signal, and the measured zero signal.